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REGIONAL INFORMATION FOR ECONOMIC, DEMOGRAPHIC & ENERGY ANALYSIS

A 1980 HYBRID INPUT-OUTPUT MODEL

FOR

THE SAN FRANCISCO BAY REGION

ABAG ASSOCIATION OF BAY AREA GOVERNMENTS   Oakland, California

Errata

page 6   Equation (8) should read $X = \dfrac{I}{I-A} \, Y$ or $(I-A)^{-1}Y$

page 7   Defining the variable dimension $r_1 = m \times m$ not $m \times n$.

page 8   value added--- government, not elsewhere classified--- should
          read 5, 059, 594   not 5,865,101.

page 21   references-- include the following:
          Carter, A.P., "Structural Changes in the American Economy,"
          Harvard University Press, 1970.

          Chenery, H.B. and P.G. Clark, "Interindustry Economics,"
          John Wiley, New York, 1959.

          Czamanski, S. and E.E. Malizia, Applicability and Limitations
          in the Use of National Input-Output Tables for Regional Studies,
          " Papers and Proceedings, Regional Science Association, (23) 1969.

Appendix Table 3, page II should be page I, and page I should be page II.
          Reverse order of first two pages.

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ASSOCIATION OF BAY AREA GOVERNMENTS,
OAKLAND, CALIFORNIA

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Introduction to Input-Output Analysis

Input-output tables provide a flexible framework for analysis of issues of significance to planners and policy makers. This task is accomplished by disaggregating an economy into its constituent sectors, providing a format within which these sectors can be studied in depth and relating structural interdependence of the economy to consumption patterns.

Historically, the first known attempt to organize the macro-economy can be traced to Francois Quesnay who published Tableau Economique in 1758. Quesnay depicted the economy as an economic system in which the circular way in which wealth was generated and reflected in the operations of a single establishment, a farm. (See Kuczynski and Neer, 1972)

About a century later, in 1874, Leon Walras published Elements d'economic politique pure. This study presented a theoretical general equilibrium model which essentially consisted of a set of equations illustrating the price mechanism in the economy (See Jaffe, 1954).

The culmination of the work started by Quesnay came in the 1930's when Professor Wassily Leontief of Harvard developed a general theory of production based on the notion of economic interdependence and published the first input-output table of the American Economy (See Leontief, 1936). Leontief ignored prices, and consequently substitution, and assumed that any product was supplied by only one sector and that there were constant return to scale, so making possible the empirical application of input-output models. The basic equation system of an input-output model is:

$$(I - A)^{-1}Y = X \tag{1}$$

where: A = a Matrix of interindustry technical coefficients
   Y = a Vector of Final Demands
   X = a Vector of Gross Outputs
   I = an Identity Matrix of the same order as A.

The expression $(I - A)^{-1}$ is generally known as the Leontief inverse matrix.

Traditionally, input-output models have been used in three main areas (see Chenery and Clark, 1959). Perhaps the most important has been the use of the Leontief inverse matrix in the structural analysis of an economy. Here assumptions are made about changes in the level of sectoral final demands, for example. The effect on the whole economy, or on sectors within the economy, is assessed by studying the rows, or the columns, of the inverse table--depending on whether the focus of interest is on the direct and indirect impact of a unit increase in the final demand of one industry on all other industries, or on the effect of all final demands on the sales of a particular industry. Other applications in the field of structural analysis might involve

changing the level of imports or adjusting individual entries in the original transactions table which shows the pattern of interindustry sales and purchases, and assessing the ramifications throughout the economy by computing a new inverse matrix.

A second major area of applicatons work has involved the use of input-output tables as the basis of regional and national forecasting exercises. In many respects, this type of work is closely related to the structural studies referred to above, since projections invariably involve the use of an inverse matrix and a vector of final demands. However, in a forecasting exercise the final demand vector has to be predicted independently in terms of all of its components, and in this respect differs from a structural study in which only one element of final demand may be changed. When the Leontief inverse is used for forecasting, the final demand vector is multiplied by the inverse matrix to give a new vector of total outputs. If a new transactions table is required, this output vector has to be multiplied by the original direct coefficients table, so emphasising again the assumption that the technical relationships between industries are invariant over time. The weaknesses inherent in this type of approach stem from the assumptions that the technical coefficients remain unchanged, and that the level of output is to some extent a function of some exogenously specified level of investment. In an attempt to improve the accuracy of forecasting based on input-output models, modifications have been introduced to the basic model described above to make it more dynamic and to allow for changes in interindustry relationships. The theoretical problems of dynamic models have been largely solved (Leontief, 1970), but empirical applications have lagged somewhat because of data problems.

A third major area of application work has involved the detailed study of the nature of interdependence in an economy. This kind of analysis can be especially valuable in comparing the economic structure of different regions of the country. In this way, one is able to examine possible growth paths of each region and identify capacity bottlenecks.

Unfortunately input-output accounts in the United States have encountered deep seated resistance in the past over the question of whether the method would facilitate any move toward central planning, Evans and Hoffenberg as presented by Polenske allude to this resistance: (See Polenske, 1980).

> "An illusory fear is that the [input-output] approach constitutes a potentially undesirable planning device. The word "planning" has acquired a rather unsavory semantic content, especially when linked with the word "government." It has come to imply some kind of belief that productive operations should be directed by a central authority; in other words, a belief in some form of socialism. This has been extended to imply that any device that might make planning more practical is somehow undesirable. When

clearly stated, this is an obvious non sequitor.

A good deal of misunderstanding about what the interindustry-relations approach can do, or is intended to do, undoubtedly comes about through the vague meaning of the word planning. . . . The suggestion that interindustry relations, as a technical device, might help to make socialism more "practical" is arguable but irrelevant. . . . another fear of misuse related to planning is that input-output methods may somehow be used in connection with the imposition of production controls and materials allocations. . . ."

San Francisco Bay Area Input-Output Model

The San Francisco Bay Area Input-Output Model is a spacial model of a single region for the year 1980. Each cell in the interindustry transactions table shows the amount that an industry in the region purchases from itself or from other industries in the same region. Trade flows between regions is usually dealt with only in terms of total inflows and total outflows, which are not differentiated by region of origin or desination. Data required to implement the model are regional interindustry flows for a base year and regional demands for a given year.

The basic assumptions made in the construction of the San Francisco Model are the following:

    a) constant returns to scale
    b) homogeneous products with no joint production
    c) fixed direct input (technology) coefficient
    d) no subsitution of one input for another

The San Francisco Input/Output Model is part of a larger system that contains a production-capacity constraint feedback system (See Brady and Yang, 1982) which is lacking in most dynamic final demand models. The assumption of constant returns eliminates the impacts of external economics on the production process, and the second assumption assumes identical products within an industry. The third one assumes fixed technologies. A check of the national 1967 and 1972 input-output tables indicated that for most industries the technical coefficients were relatively stable. Carter (See Carter, 1970) has verified that input-output coefficients remained relatively stable for the U.S. for the years 1939, 1947, 1958 and 1961 over the short-run. The major shifts in production and input substitution brought on by the energy crisis may have created changes, but empirical testing of the impact on technologies will have to wait the publication of the 1977 national input-output table.

Input-Output Coefficients

The discussion thus far has been limited to the framework for tracing the actual flows of goods and services among industries. Having

determined the historical network of interindustry transaction, how can we use this pattern to forecast future levels of industry activity? More specifically, what determines the values X_i and X_{ij}?

Economic theory offers a hypothesis to explain the relationship between the purchases by industry j_{th} from industry i. The magnitude of X_{ij} depends on the level of output of the j_{th} industry. Increases or decreases in the output of an industry are to be accompanied by increases or decreases in the various current inputs absorbed by the industry. This proposiston is merely a statement of the law of costs--larger outputs require more inputs--and may be described generally as follows:

$$x_{ij} = F(X_j) \tag{2}$$

This form does not specify the exact character of the relationship. The law of costs requires merely that this relationship be restricted to make the function a monotonically increasing one. Under these conditions the ratio of x_{ij} to X_j need not be constant. It is usual, however, to write this relationship in a more restricted form, namely:

$$x_{ij} = a_{ij} X_j \tag{3}$$

where a_{ij} is a constant coefficient of production termed a "flow coefficient." It implies a linear homogenous relationship between the output of an industry and the various industrial supplies and services the industry must purchase to produce output. This form of production coefficient is not a theoretically valid generalization but is an approximation.

Each of the a_{ij} values is estimated from past ratios of x_{ij}/X_j. A complete set of flow coefficients for an input-output model of industries forms a square matrix

$$
\begin{matrix}
a_{11}, & a_{12} & \cdots & \cdots & a_{1n} \\
a_{21}, & a_{22} & \cdots & \cdots & a_{2n} \\
\cdot & \cdot & & \cdot & \\
\cdot & \cdot & & \cdot & \\
\cdot & \cdot & & \cdot & \\
a_{n1}, & a_{n2} & \cdots & \cdots & a_{nn}
\end{matrix}
\tag{4}
$$

in which each column describes the estimated fraction materials, energy, and services required from other industries by a given industry per one dollar of its output. By treating flow coefficients (a_{ij}) as independent structural parameters in a system of equations, the substitution effects caused by relative price changes are ruled out.

Some argue that the importance of substitutin due to changes in relative prices has been exaggerated in production economics. The degree of complementariness among inputs is so high that even wide variation in their relative prices could only slightly affect the combination of inputs that would be used. Moreover, insofar as relative price changes are important to particular industries, such changes themselves are in large part the consequences of technological changes. That is, changes in the technology of production alter the industrial demand for inputs and, through this impact upon market, lead to relative price variations. If this is so, it is more the coefficient structure of production which determines prices that prices determining the coefficient structure. However, the issue is not a matter of basic theory but a matter of emphasis; the assumption of fixed coefficients within a given technology is used as a pragmatic simplification.

The development of the flow coefficient matrix is central to the input-output concept because it sets behavioral patterns for translating the implications of a set of final demands (Y's) into levels of industry activity (X's) required to achieve those final demands.

The economic significance of the flow coefficient matrix is that both the direct and indirect production requirements implied by any level of final demand can be solved. For example, if the demand for auto-mobiles changes by $1.00, the coefficient column for automobiles describes the direct inputs the automobile industry needs in order to increase its deliveries to final users by that amount. Its purchases of steel, glass, paper, paints, electrical parts, fuel and so forth, are described by its column in the coefficient matrix. Suppliers of these products, in order to make deliveries to the automobile indus-try, must purchase inputs from other industries, whose amounts per dollar of their sales likewise are described by their column coefficients. These suppliers in turn place orders with other sup-pliers. The demands upon the outputs of each industry to support the production of $1.00's worth of automobiles may be accumulated to show how much production must take place in each industry to supply the automobile industry, its suppliers, and their suppliers' suppliers, etc. This computation is analogous to the Keynesian income multiplier which measures the effects of changes in respending for consumption upon income; but in the input-output framework, the respending effects for inputs are accumulated and it is the output (or sales) of each industry which is measured.

A more convenient way, certainly more compact, of representing a system of input-output equations is in vector and matrix notation. Let X represent a vector of outputs whose values are to be determined for each of n industries, Y represents a vector of final demands, and A the matrix of flow coefficients. Then,

$$X = AX + Y \tag{5}$$

which states that the outputs of different industries depend upon the demands for inputs by industry and demands for inputs by final users. Since the A matrix is a given constant and the Y vector is independently determined, the solution of the X vector is obtained as follows:

$$X - AX = Y \qquad\qquad (6)$$

$$(I-A)X = Y \qquad\qquad (7)$$

where I is an identity matrix bearing the relationship in matrix notation of the number one in the diagonal and zeroes elsewhere. Dividing both sides by (I - A) we obtain:

$$X = \frac{1}{1 - A} \; Y \quad \text{or} \quad X = (1-A)^{-1}Y. \qquad (8)$$

The expression $(I - A)^{-1}$ is called the inverse matrix. Such a table constitutes the focus of an input-output study for impact analysis since it indicates both the direct and indirect effects upon the output of every industry per dollar's worth of final demand for the output of any one industry. It is a table of industrial output multipliers.

Adjusting National Matrix to San Francisco Bay Input-Output Matrix

In an article entitled "An Appraisal of Non-Survey Techniques for Estimating Regional Input-Output Models," David G. McMenamim and Joseph Haring state (See McMenamin and Haring, 1964) that:

> "Non-survey or minimum-survey methods for constructing regional input-output tables are attractive to model builders because of the relatively small cost involved as compared with full survey models."

McMenamin and Haring go on to state that many of the non-survey techniques have not been highly successful in the past, but recently accuracy seems to improve by the use of newly developed techniques. Indeed, the full survey of building input-output tables are costly.

The basic method employed in this study to adjust the national Input-Output table to the San Francisco Bay Area is the RAS or Biproportional Matrix Adjustment Method. The basis of the RAS Method is the hypothesis [See Stone] that various determinants of change in input-output coefficents (economies of scale, technological evolution, variations in relative prices) may be summarized by biproportional relationships in which each industry is characterized by a pair of "substitution" and fabrication multipliers (r_i and s_j respectively) which are assumed to operate uniformly over the rows and columns of the input-output matrix. In its simplest form, RAS involves the determination of a unique set of values for r_i and s_j which when applied to an observed base year coefficient matrix A, generates a

second matrix A_1 whose elements generate a pair of vectors U_1 and V_1 representing observed values of intermediate outputs and inputs by industry in the update year. In mathematical terms, the problem is therefore to find:

$$A_1 = r_1 A s_1$$

where: A = a nonnegative m x n matrix that is mapped by row and column multiplication into a nonnegative m x n matrix A_1

   r_1 = An unknown m x n diagonal matrix of row multipliers

   s_1 = An unknown diagonal n x n matrix of column multipliers.

   $R_1 S_1 > 0$

when this biproportional relation is to be solved for A_1 and r_1 and s_1 by means of known row totals u and column totals v prescribed for A_1, by using the RAS procedure, the existence problem of constrained biproportional matrices has to be considered. The iterative RAS procedure is a way of approximating a solution asymptotically.

To quote Bacharach (See Bacharach, p. 46)

   "Starting with the given Matrix A, one multiplies each row by a scalar that will make the row sum equal the row constraint, next multiplies each column of the resulting A^1 by a scalar that will make its sum equal its constraint. This given a Matrix A^2 that serves as a starting point for the next iteration."

This process of row and column multiplication continues until the calculated intermediate inputs and outputs are equal to observed levels for each industry. The process is mathematically efficient and convergence occurs usually around the ninth iteration.

Before the biproportional adjustment procedure was applied to the 1972 national I/O model, location quotients were used to identify those sectors where regional specialization was most significant. Using information from Czamanski and Malizia (See Czamanski and Malizia, 1969), we looked at those quotient which were in excess of 1.5. The variable 1.5 was arbitrarily determined. Professional review of row and column cells focused on these sectors.

Smith and Morrison undertook a test of the best known methods for adjusting survey based I/O tables for the same spatial area and found "the semisurvey method based on the RAS technique proved to be by far the most efficient simulation procedure, judged according to the distance of the estimated trade coefficients matrix from the survey-based table." (See Smith and Morrison, p. 78)

TABLE 1
ECONOMIC LEVEL OF 1980 ABAG REGIONAL INPUT OUTPUT MODEL
(* 1,000)

SECTOR NAME	GROSS OUTPUT	INTERMEDIATE		FINAL DEMAND	VALUE ADDED
		OUTPUT	DEMAND		
AGRICULTURE, FORESTRY, AND FISHERIES	675005.	327687.	272053.	347318.	257852.
MINING	136001.	105284.	30241.	32717.	62160.
CONSTRUCTION, RESIDENTIAL	3606912.	0.	1499034.	3606912.	940663.
CONSTRUCTION, NON-RESIDENTIAL	1499600.	0.	565104.	1499600.	382548.
CONSTRUCTION, HIGHWAYS AND PUBLIC UTILITIES	990000.	0.	489593.	990000.	267300.
MAINTENANCE AND REPAIR	819000.	534485.	234600.	264515.	458640.
ORDNANCE	1847800.	49393.	439768.	1796407.	242062.
FOOD AND BEVERAGES	6004397.	1191663.	2019262.	4812734.	1939420.
TEXTILE AND APPAREL PRODUCTS	978545.	533624.	229523.	444921.	368911.
LUMBER, WOOD AND PAPER PRODUCTS AND FURNITURES	1602148.	857238.	326588.	744910.	656861.
PRINTING AND PUBLISHING	1842287.	909063.	425181.	933224.	1191959.
CHEMICALS AND ALLIED PRODUCTS	2392800.	857428.	761555.	1535372.	1136580.
PETROLEUM REFINING AND RELATED INDUSTRIES	8364589.	2812447.	1763132.	5552142.	1731470.
RUBBER AND LEATHER PRODUCTS	643128.	441248.	155009.	201880.	332497.
STONE, CLAY, GLASS, AND CONCRETE PRODUCTS	1682352.	564382.	468112.	1117970.	891647.
PRIMARY METAL INDUSTRIES	1173875.	514990.	363300.	658885.	415552.
FABRICATED METAL PRODUCTS	2390572.	1336305.	731550.	1054267.	1226363.
NON-ELECTRICAL MACHINERY, EXCEPT COMPUTERS	1500000.	684681.	239207.	815319.	869500.
COMPUTERS AND OFFICE EQUIPMENT	3659000.	1057976.	1081798.	2601024.	2041722.
ELECTRIC TRANSMISSION AND INDUSTRIAL APPARATUS	555294.	265265.	69113.	290029.	306522.
HOUSEHOLD APPLIANCES,LIGHTING EQUIPMENT,RADIO,T. V	1752393.	495146.	279901.	1257247.	1033912.
ELECTRONIC COMPONENTS AND EQUIPMENT	3704234.	1379087.	475712.	2325147.	2474428.
TRANSPORTATION EQUIPMENT	2133028.	98969.	342969.	2034659.	1045478.
PROFESSIONAL, SCIENTIFIC EQUIPMENT AND MISCELLANEO	2041452.	633362.	484869.	1408090.	1290197.
TRANSPORTATION SERVICES	3044419.	1118377.	1015735.	2526042.	2059096.
TRUCK TRANSPORTATION	1733474.	1108527.	641975.	624947.	745394.
COMMUNICATION	2015824.	816589.	412243.	1199235.	1376807.
UTILITIES	5348877.	2740871.	1730739.	2608006.	1604663.
WHOLESALE TRADE	4620041.	1944355.	2015865.	2675686.	1601815.
RETAIL TRADE	7859561.	1157666.	3022789.	6701895.	3536802.
F.I.R.E.	16202666.	4863465.	3880037.	11399421.	10733505.
HOTELS AND LODGING PLACES	763550.	64439.	342602.	699117.	234412.
PERSONAL AND REPAIR SERVICES	2263264.	687642.	558416.	1575622.	1292323.
BUSINESS AND PROFESSIONAL SERVICES	5759079.	2976762.	1362821.	2782297.	3466965.
AMUSEMENT AND RECREATION SERVICES	778597.	248041.	201042.	530856.	468896.
HEALTH SERVICES	5940000.	384775.	1064865.	5555225.	4395600.
EDUCATION SERVICES ,NON-COMMERCIAL R & D,NON-PROFI	5683478.	178603.	1012877.	5504875.	3751095.
GOVERNMENT NOT ELSEWHERE CLASSIFIED	8260707.	396982.	3023507.	7863725.	5865101.

INDUSTRY SECTOR IDENTIFICATION

Number	Description	1972 S.I.C.
1.	Agriculture, Forestry, Fisheries	01-09 (Excluding 047)
2.	Mining	10-14
3.	Construction, Residential	152, 153, 171, 172, 1751, 1752
4.	Construction, Non-Residential	154, 173, 174, 176
5.	Construction, Highways and Public Utilities	161-162
6.	Maintenance and Repair	176, 177, 178, 179
7.	Ordinance	348, 3761, 3795
8.	Food, Beverages	20, 21
9.	Textile and Apparel Products	22, 23
10.	Lumber, Wood, Paper Products Furniture	24-26
11.	Printing and Publishing	27
12.	Chemicals and Allied Products	28
13.	Petroleum Refining and Related Industries	29
14.	Rubber and Leather Products	30, 31
15.	Stone, Clay Glass and Concrete	32
16.	Primary Metals	33
17.	Fabricated Metals	34 (exc. 348)
18.	Non-Electrical Machinery, Except Computers	351-356, 359, 358
19.	Compters and Office Equipment	357

20.	Electric Transmission and Industrial Apparatus	361, 362
21.	Household Appliances, Lighting Appliance, Radio, T.V., Communication Equipment	363, 364, 365, 366
22.	Electronic Components & Equipment	367, 369
23.	Transportation Equipment	37 (exc. 3761, 3795)
24.	Professional, Scientific Equipment and Miscellaneous Manufacturing	38, 39
25.	Transportation Services	40, 41, 44-47 (exc. 4789)
26.	Truck Transportation	42, 4789
27.	Communication	48
28.	Utilities	491, 492, 493, 494-497
29.	Wholesale Trade	50-51
30.	Retail Trade	52-59
31.	F.I.R.E.	60-67
32.	Hotel and Lodging Places	70
33.	Personal and Repair Services	72, 75, 762-764, 7396
34.	Business and Professional Services	73 (exc. 7396), 769, 81, 89 (exc. 892)
35.	Amusement and Recreational Services	78, 79
36.	Health Sciences	80, 074
37.	Local Educational Services, Non-Commercial R&D, Non-Profit Professional Organizations	82, 83, 84, 86, 892
38.	Government, Not Elsewhere Classified	91-97, 4311

Table 1 presents estimated gross output, final demand, intermediate demand and output levels and value added for the period 1980. They represent the estimated economic potential of the nine counties that compose the San Francisco Bay Region. Data sources for those values were:

Annual Survey of Manufacturing
California Franchise Tax Board
Annual expenditure reports of local governments
Annual reports of public utilities in the Bay Region
Annual construction reports and value of construction permits issued
California Statistical Abstract

All values are expressed in 1980 dollars.

Direct Coefficient Matrix of the San Francisco Bay Input-Output Model

Table 2 presents the industry sectors. (All remaining tables are found in the appendix of this report). Table 3 contains the 1980 Direct Coefficient Matrix. The regional economy is represented by thirty-eight industry sectors, representing the trade flows between industries in the nine-county region. Each row shows the fraction of total sales by the sector named at the left to all sectors in the nine-county area, and the final demand sectors in the region.

Inversion of Direct Coefficient Matrix

Table 4 presents the inverted $(I-A)^{-1}$ direct coefient matrix for the 1980 regional model. This table shows the direct and indirect requirements per dollar of delivery to final demand by each of the industry sectors. As is customary, households are not included because they are not considered a processing industry in this basic table. The inclusion or exclusion of households is not a matter of whim or judgment. Because most sales to households are for final consumption, rather than for intermediate use, households constitute an important component of final demand. Each time one of the proces-sing sectors adds one dollar to final sales the direct and indirect effects are obtained by reading down that sector's column. For example, every dollar of output of the computer and office equipment sector requires 5.1 cents worth of parts from the electronic industry in the Bay Area. For each increase in sales to the computer and office equipment industry in the Bay Area, the electronics industry must also increase their purchases from local sectors that supply them. Therefore, each additional sale to final demand sets off a chain reaction, and when the efects of all the successive "ripples" of purchases have been worked out the direct and indirect requirements from the computer industry for each additional dollar of sales to final demand by the computer industry increases to 7.2 cents, a 2.1 cent or 41% increase over direct requirements.

By comparing Table 3 and Table 4, it is possible to determine for each

sector the difference between direct and indirect requirements.

Table 5 presents the results of including households in the processing sectors. The purpose of the inclusion is to develop income multipliers. In literal terms, this table includes the impacts of labor and inputs on the ripple effects of changes in final demand. It assumes also that economy becomes self-contained in the region, resulting in little or no leakage property income outside of the region. After creation of a direct, indirect and deduced table, Type I and Type II income multiplier may be produced. Following the procedure by Richardson (See Richardson, page 39), these multipliers were developed. In the open model (excluding households as a processing sector) (See Table 4), the column sum is defined as output multiplier. These multipliers by industry measure the sum of direct and indirect requirements from all sectors needed to deliver one additonal $1.00 of output to final demand. Although the output multipliers represent total requirements per $1.00 of final demand, they are not particulary useful, except as indicators of the structural interdependence between each sector and the rest of the economy. That is the higher the multiplier, the greater the interdependence with other local sectors. Normally, the highest multipliers are found in construction, trade and services sectors. This stands to reason because the sectors import little into the region relative to other sectors, but purchase major inputs from production industries locally.

Multiplier Analysis

Uses of input-output models fall into two categories, regional forecasting and multiplier analysis. A regional forecast is a projection into the future of the behavior of the regional economy in its entirety. In contrast, multiplier, or impact, analysis predicts the overall change in the economy usually as a consequence of an isolated change in the final demand of one of its industries. Of the two uses, multiplier analysis is be far the more common, being extensively employed for decision-making in both the private and public sectors.

The purpose of this section is to show the derivation of the multipliers from the San Francisco Bay Area input-output study and to discuss their proper application. Although the basic notion of a multiplier is a relatively simple one, the first step is to outline a few of the fundamental ideas underlying input-output multipliers, some of which tend to make their application more difficult than is first apparent. Later in this section, these thoughts will be further discussed in the context of some specific examples of multipliers and impact analyses.

Basic Multiplier Concepts

At the start of our discussion, there are four points that might be
made with regard to input-output multipliers. The first deals with
the general definition of a multiplier. Multipliers measure the
repercussions of the change in the level of one economic variable on
the level of another variable. In the context of a Keynesian macro-
economic model, one commonly studied multiplier is the government
expenditures multiplier, which estimates the change in aggregate
income as a consequence of a dependent variable (in our example,
income) in the numerator and the independent variable (government
expenditures) in the denominator. There are a vast array of multi-
pliers of potential interest to economists. Indeed, the conceivable
number of combinations of dependent and independent variables forming
multipliers is infinite. For regional analysts, reference to commonly
used multipliers is found in expressions like "the income in regional
income from an increase in the exports of farm commodities"or the
decline in the total number of local jobs as a result of the closure
of a plywood mill."

The second point is a reiteration of an idea that the Leontief inverse
matrix is the basic ingredient in input-output multiplier analysis.
As we have noted, the general solution of an interindustry model is
given by equation,

$$X = (I-A)^{-1}F$$

The inverse matrix is a table of output multipliers, representing the
repercussions on the output of individual industries from changes in
the final demands of other industries. For a 38-industry input-output
model, there are 1,444 (38 x 38) output multipliers in the inverse
table. These output multipliers are not only of importance in their
own right, but they provide the bridge to a variety of other useful
input-output multipliers. For example, a value added multiplier,
showing the Gross State Income required directly and indirectly from
industry i to support a dollar of final demand of j, is a simple
transformation of the output multiplier. If the value added
coefficient, v_i, measures the value added in industry i per dollar of
output (i.e. $v_i = V_i/X_i$, where V_i is the value added in i), the valued
added multiplier, $_vM_{ij}$, is given by

$$_vM_{ij} = v_ib_{ij}.$$

Similar multipliers, including their aggregate counterparts (i.e., the
so-called Type I and Type II multipliers), can be developed for income
and employment, as is demonstrated in a later sub-section.

The third fundamental notion about input-output multipliers is that
their values are dependent upon the restrictions implied by the speci-
fication of the interindustry model. Three key assumptions employed
in regional input-output formulations involve the form of the output
equations, the stability of purchases coefficients, and model closure.

Primarily because of the ease with which the mathematical model can be manipulated, the output equations are usually assumed to be linear and homogeneous. Furthermore, in order to render the model operational for forecasting purposes, the assumption of constant regional coefficients is commonly invoked. The issue of closure deals with the degree to which the variables of the model are made endogenous. In impact studies income and consumption are treated as endogenous variables (the Type II formulation of an input-output model), although this is not always the case. In any event, if one or more of these restrictions are modified (e.g., if regional coefficients are assumed to vary in the future at some projected rate), the values of the multipliers will be altered. Analysts should always keep in mind the implication that model specification has for values of multipliers and impact assessments.

The final point is also related to model specification. The multipliers derived from the San Francisco Bay Area input-output tables are described as being static, since the underlying models, which depict the regional economy in timeless states of equilibrium without taking into account the length of time required to make the adjustment. More general specifications of input-output systems would consider the effects of time. Multipliers derived from formulations in which time lags, variable capital stocks, or temporally changing coefficients play a role are termed dynamic.

Specification of Multipliers

A summary measure of the potential impact on the regional economy of an expansion or decline of an industry is given by that sector's aggregate multiplier. Input-output multipliers of this sort are derived from the inverse matrices, and can be stated in terms of value added, income, and employment, among other variables, depending upon the problem at hand.

A so-called Type I income multiplier for sector j expresses the sum of the direct and indirect income changes in all industries of the economy from a dollar increase in the final demand of j. As we have previously noted, this multiplier is a simple transformation of the output multipliers given in the inverse matrix, B. If h_i is the household coefficient for sector i, the Type I multiplier for j is expressed as:

$$_h M_j = \sum_{i=1}^{n} h_i b_{ij}.$$

The Type II household multiplier captures the repercussionary effects of the feedback loop that runs through earned household income and consumption expenditures. It therefore measure the direct, indirect, and induced value added in all industries per dollar of final demand of industry j. The inverse matrix, B, in this case is based upon a direct requirements matrix, R, expanded to include a household row and column. For this model, now with n+1 endogenous sectors, the Type II household multiplier is given by:

$$II \; _h M_j = \sum_{i=1}^{n+1} h_i b_{ij}^{*}.$$

Regional impact analyses are frequently preoccupied with the employ-
ment-creating effects of industrial expansion, because regional policy
makers may be primarily and legitimately concerned with forecasting
jobs in a particular area. For this reason, it is often useful to be
able to derive employment multipliers, as well as income multipliers
from the I/O model.

Given the slopes of the employment-production functions, the cal-
culation of employment multipliers is relatively straightforward. The
direct employment change for sector j is the slope of its employment-
production regression line. The direct plus indirect employment
change for j consists of E/X coefficient for each i multiplied by the
total direct and indirect requirements from each i for one unit of
final demand to j, and summed:

$$eM_j = \sum_{i=1}^{n} e_i b_{ij}.$$

The above multiplier is analagous to the Type I income multiplier and
is the ratio of this direct plus indirect employment change to the
direct employment change. Similarily, there is an employment multi-
plier parallel to the Type II income multiplier which measures the
ratio of the direct, indirect and induced employment change to the
direct empoyment change. The former is given for sector j by:

$$II\ eM_j = \sum_{i=1}^{n} e_i h^*_{ij}.$$

where h^*_{ij} represents an entry in the expanded inverse matrix with
households endogenous.

An important consideration about Type II multipliers for both employ-
ment and income should be stated. Since Type II multipliers assume
that the economy is "closed", (that is, there is no leakage of income
from the economy), Type II multipliers should be viewed as the
theoretical maximum impact level. In reality, the actual multiplier
probably will fall somewhere between the type I and Type II levels.

Numerical Examples of Multiplier Usage

Tables 6 and 7 present output, income and employment multipliers for
the 1980 San Francisco Bay Area I/O model. It may help to clarify the
preceding analysis to illustrate the use of multipliers. Assume that
a retail outlet plans to open in a community and that total estimated
sales will be $1,000,000. per year. We want to estimate the output,
income and employment impacts of this additional business on the
region's economy.

First, estimate output impacts. Sales to final demand rise by
$1,000,000. This is multiplied by th output multiplier. That is
$1,000,000 X 1.5342 = $1,534,200. Therefore, the total regional impact
of a $1,000,000 increase in sales to final demand or retail trade is
$1.5 million. This includes the $1 million direct impact and the $532

thousand indirect impact both on retail trade and all other sectors.

Next, let's estimate the type I income impact of the increase to final demand on the regional economy. We multiply the increase by the multiplier by the household row. That is, $1,000,000 X 1.54 X 0.4269 = $657,426. This amount represents the total income impact associated with a $1 million increase in final demand at the regional level. The type II multiplier impact is: $1,000,000 X 3.75 X 0.4269 = $1,600,875.

Finally, calculate the employment impact. Table 7 shows that the slope of the employment - production function is 0.0506. That is, for every $1,000 of output increase employment increases by 0.0506 job. Therefore, with an increase to final demand by $1,000,000 results in a job increase of (0.0506 X $1,000,000)/$1,000 = = 50.6 jobs . Next, we calculate the type I employment impact which is 1.19 X 50.6 = 60.2. Hence, the direct impact was 50.6 jobs and the indirect impact was 60.2 - 50.6 = 9.6 jobs. Using Type II employment impact multipliers indicates that the direct, indirect and induced impact was 50.6 x 2.22 = 112.33 jobs. The indirect and induced impact was 112.33 - 50.6 = 61.73 jobs.
A note of caution should be voiced with employment multipliers. Of the multipliers mentioned, the emlployment multipliers are the least stable. Technological substitution tends to reduce the labor portion of the direct coefficient which reduces the overall impact. Therefore, although these estimates are for 1980, the Type I and II multipliers may overestimate the employment impact given technological change over time in the specific industries.

Some Considerations in Multiplier Analysis

The popularity of input-output for economic analysis is due in part to the simple and understandable structure of the model. Still, one can find many misuses--and even abuses--of input-output models. Although this is not the place for a thorough discussion of the methodology of impact studies, we might set down a few considerations, and in some cases words of caution, to be kept in mind during the course of a multiplier analysis. Some of these thoughts are only a re-emphasis of fundamentals that have already been discussed.

1. There is no single multiplier for an economy. One often hears the question, "What is the multiplier for the Bay Region?" Clearly, this queston does not make much sense, since there are in fact many multipliers.

As we have noted earlier, a multiplier is an estimate of how one variable of the economy is expected to change when some other variable changes. A multiplier is composed of two parts, the dependent change (for example, the change in labor income) and the independent change (the increase in Other Foods' exports). the multiplier is simply the ratio of these two changes, the dependent change being the numerator and the independent change being the denominator. Conceivably, there

are an infinite number of possible combinations of numerators and denominators and therefore an infinite number of possible multipliers. Some examples of multipliers not given that one might encounter are the following: the output of industry A per dollar of exports of industry B (i.e., the output multipliers given in an inverse matrix); the total payroll in the economy per dollar of direct payroll in industry C; the total regional value added per dollar of personal income; and total labor income per dollar of investment.

2. Multipliers are specified according to quite simplified assumptions concerning the behavior of the economy in response to-change in demand and income. The value for a given multiplier is dependent upon the behavioral assumptiions underlying the input-output model.

It is not possible to measure the "true" impact of a given change in an economy, since input-output models cannot depict exactly an economy's complex reaction to such a change. It is therefore not possible to state how much bias is associated with a given multiplier; that is, we cannot tell how much forecasting error is entailed with use of a given multiplier associated with our specifications. In any event whatever the choice of multipliers, the analyst should be aware of the possible bias in the impact assessment because of the restrictions inherent in the model's specification.

3. Accurate estimates of the direct impact are important. The most straightforward approach to estimating the impact on regional income of a plant expansion is to use the Type II income multiplier of the industry to which the plant belongs. This procedure of course presumes that the plant has an input structure equivalent to that of the industry as a whole. When one has no further information on hand, this is the most reasonable assumption to adopt.

However, when one does know the make-up of the plant's direct purchases vector, this information should be incorporated into the impact assessment. The basic reason for this is that once the direct value added is known, and one has reliable estimates of the other direct regional purchases, a good portion of the impact has been measured. As evidence of this contention is the fact that for many sectors the direct income coefficient represents about one-half of the total Type II income multiplier.

Furthermore, use of the aggregate industry multiplier can be misleading. Since each industry, even in the 38-sector input-output model, consists of establishments producing a variety of goods and services and requiring different bundles of inputs, a given establishment's multiplier may be quite different from the "average" industry multiplier.

4. The use of historical multipliers should be of minor concern on impact studies. Criticism of input-output models has focussed upon the assumption of temporally constant coefficients, an assumption commonly invoked to render the models operational. There are several

potential causes of regional coefficient change--tehnological change, variations in product mix, price changes, input substitutions, and shifts in trade patterns--but the question of coefficient instability is essentially an empirical one. The criterion with which to guage the importance of coeficient change is the degree to which such change impinges upon the quality of input-output forecasts. For impact analysis this issue reduces to a consideration of the stability of multipliers over time.

For income impacts the use of historical multipliers does not seem to be a critical problem. The criterion for making this judgment is not the size of the forecasting error introduced into impact analyses because of unstable multipliers over time relative to the forecasting errors generated by other factors.

We should point out again that the constant multiplier assumption is not valid for Type II jobs multipliers, as we have defined them here. While it may be reasonable to assume that the aggregate income of an economy required directly and indirectly to support a given increase in the final demand of some industry does not change over time, we do expect the employment requirements to decline because of productivity gains. It is therefore necessary for analysts to update job multipliers by etimating the jobs-per-output ratios for the relevant forecasting period.

As a means of capsulizing this contention, we might suggest a list of concerns for input-output practitioners when making impact studies. Five concerns are listed in their apparent order of importance. These are (1) the possible misuse of multipliers; (2) the choice of the specification of the input-output model; (3) measurement error in the direct purchases vector; (4) measurement error in the base-year input-output model, especially if it is not derived from a survey-based table; and (5) the temporal instability of multipliers.

5.   High multipliers are not necessarily good; and low multipliers are not necessarily bad. It is sometimes suggested that development of Industry G instead of Industry H should be promoted since the former has a higher multilplier. Such statements contain at least two fallacies. First, as we have seen, an impact is multi-dimensional, entailing induced effects on a number of economic variables. To put this in other terms, one should take into account more than one multiplier when evaluating the relative benefits of alternative expansions. And while Industry G may have a higher labor income multiplier, Industry H may have a higher employment multiplier.

The second fallacy is that a consideration only of industry multipiers neglects the relative costs of proposed developments. It may well be that Industry G has consistently higher income and employment multipliers than Indusry H, but that the cost of promoting the regional expansion of G--in terms of public investment, tax incentives, and the like--is prohibitive. In general, the decision to promote one industry and not others is a complicated choice involving the assessment of

both benefits and costs of all possible alternatives. Individual input-output multipliers enter into this decision as only one of many criteria.

6. <u>Multipliers, and impact asessments, represent only estimates of the anticipated economic efects of some external change.</u> A multiplier analysis is a forecasting exercise, and forecasts are bound to be wrong, at least to a degree. As apparent from the previous discussion, inaccuracies in impact statements will occur for a number of reasons: the misuse of input-output models; model misspecification; incorrect projections of the direct impact; measurement errors in the base-year coefficient estimates; and outdated input-output coefficients. The first reason is inexcusable, while the last four are unavoidable. It is therefore nonsensical to estimate the income effects of, say, a bilion-dollar Aerospace expansion down to the last dollar, or even to state that the Type II income multiplier for computers is 2,8495. It would be preferable to give impact asessments in terms of a confidence interval, such as $200 million of income give or take $80 million. However, given such problems as model specification, the degree of uncertainty is not always mesureable or even apparent. Nevertheless, the analysts should bear in mind that future economic behavior is never certain, and that multipliers as indicators of that behavior are only estimates.

A Technical Note on Approximating The Leontief Inverse By Means of Power Series

The expression $(I-A)^{-1}$ provides an exact solution to finding the direct and indirect impacts of the inverse of the (A) matrix (direct coefficient matrix). Miernyk (See Miernyk, 144-146K: 1965) presents an example to illustrate the approximation of the inverse by means of power series expansion. The usefulness of the power series method is that it permits the user to observe the multiple impacts of expanding a matrix to obtain a table of direct and indirect requirements per dollar of final consumption. The matrix $(I-A)^{-1}$ can be approximated by the following series:

$$F(x) = I + A + A2 + A3 \ldots \ldots + An \qquad (13)$$

Expression (13) is a polynomial of degree N and will converge if $(0 \leq A < 1)$.

As (A) is carried to successively higher powers, the coefficient will become smaller and smaller if (A) meets the constraint defined above. In economic terms, it provides a clearer understanding of the successive impacts of increasing (or decreasing) output by some level. It also provides a means by which we can identify the point where indirect and direct impacts of increasing output in the input-output table becomes negligible. Clearly, this assumes that behavior is linear and that perturbations do not occur in the system to disturb

iterations in the series. Mierynk suggests that Moore and Peterson conceptualized each term in the Power series as the interaction between changes in final demand and the transactions required to satisfy these changes in the process of production.

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APPENDIX

INPUT/OUTPUT INTERMEDIATE INDUSTRY REGIONAL FLOW TABLE-1980

	11	12	13	14	15	16	17	18	19	20
1	0.00001	0.00013	0.00001	0.00002	0.00005	0.00003	0.00005	0.00000	0.00000	0.00001
2	0.00000	0.00031	0.01049	0.00003	0.00128	0.00015	0.00001	0.00000	0.00000	0.00000
3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
6	0.00030	0.00092	0.00194	0.00046	0.00100	0.00155	0.00043	0.00015	0.00002	0.00010
7	0.00001	0.00002	0.00000	0.00001	0.00001	0.00001	0.00001	0.00001	0.00000	0.00000
8	0.00012	0.00320	0.00032	0.00476	0.00014	0.00007	0.00009	0.00007	0.00003	0.00005
9	0.00170	0.00079	0.00040	0.02936	0.00398	0.00120	0.00192	0.00071	0.00003	0.00031
10	0.04130	0.00243	0.00243	0.00929	0.01627	0.00407	0.00650	0.00117	0.00025	0.00181
11	0.00000	0.00275	0.00011	0.00060	0.00095	0.00111	0.00707	0.00026	0.00031	0.00021
12	0.00493	0.10809	0.01322	0.04950	0.01505	0.01281	0.00908	0.00100	0.00011	0.00210
13	0.00190	0.01481	0.10304	0.00387	0.01313	0.00770	0.00535	0.00379	0.00027	0.00210
14	0.00204	0.01222	0.00089	0.04061	0.00931	0.00269	0.00741	0.00328	0.00081	0.00206
15	0.00031	0.00401	0.00146	0.00250	0.06312	0.00416	0.00420	0.00135	0.00004	0.00048
16	0.00036	0.00124	0.00049	0.00181	0.00198	0.07341	0.08949	0.01790	0.00100	0.01472
17	0.00087	0.01684	0.00752	0.01148	0.00815	0.01760	0.04894	0.01250	0.00297	0.00806
18	0.00219	0.00865	0.00138	0.00704	0.00706	0.03548	0.02401	0.05409	0.00113	0.00706
19	0.00000	0.00000	0.00000	0.00004	0.00000	0.01173	0.00000	0.00015	0.21320	0.00080
20	0.00000	0.00000	0.00000	0.00000	0.00094	0.00540	0.00811	0.02235	0.00449	0.03841
21	0.00010	0.00023	0.00013	0.00127	0.00189	0.00414	0.00063	0.00068	0.00108	0.00373
22	0.00003	0.00003	0.00005	0.00003	0.00009	0.00035	0.00104	0.00590	0.05127	0.01264
23	0.00001	0.00001	0.00001	0.00010	0.00004	0.00009	0.00015	0.00027	0.00000	0.00000
24	0.00900	0.00220	0.00089	0.00538	0.00412	0.00335	0.00338	0.00234	0.00068	0.00204
25	0.00076	0.01290	0.02202	0.00943	0.01981	0.02302	0.01075	0.00188	0.00080	0.00167
26	0.00330	0.00729	0.00440	0.00584	0.02796	0.00839	0.00599	0.00160	0.00020	0.00156
27	0.00473	0.00245	0.00104	0.00208	0.00225	0.00177	0.00233	0.00130	0.00045	0.00130
28	0.00256	0.01782	0.01131	0.00710	0.02267	0.02252	0.00747	0.00218	0.00036	0.00180
29	0.01201	0.02070	0.00611	0.01857	0.02083	0.03856	0.02620	0.01086	0.00280	0.00677
30	0.00573	0.00669	0.00149	0.00310	0.00376	0.00314	0.00385	0.00201	0.00151	0.00209
31	0.01002	0.01696	0.00763	0.00812	0.01250	0.00643	0.01207	0.00397	0.00343	0.00358
32	0.00107	0.00071	0.00003	0.00071	0.00045	0.00065	0.00067	0.00013	0.00008	0.00036
33	0.00190	0.00267	0.00042	0.00171	0.00295	0.00127	0.00196	0.00076	0.00041	0.00248
34	0.01683	0.04044	0.00916	0.01230	0.01259	0.01170	0.01226	0.00460	0.00140	0.00428
35	0.00020	0.00019	0.00006	0.00007	0.00012	0.00010	0.00007	0.00008	0.00007	0.00005
36	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
37	0.00099	0.00123	0.00019	0.00118	0.00089	0.00091	0.00125	0.00033	0.00012	0.00034
38	0.00527	0.00110	0.00056	0.00075	0.00072	0.00112	0.00062	0.00033	0.00009	0.00023

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TABLE 3

INPUT/OUTPUT INTERMEDIATE INDUSTRY REGIONAL FLOW TABLE-1980

	1	2	3	4	5	6	7	8	9	10
1	0.06517	0.00000	0.00036	0.00013	0.00010	0.00002	0.00001	0.04022	0.00084	0.00004
2	0.00008	0.00094	0.00008	0.00013	0.00056	0.00023	0.00000	0.00000	0.00000	0.00002
3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
6	0.00103	0.00512	0.00005	0.00003	0.00002	0.00004	0.00047	0.00035	0.00008	0.00045
7	0.00000	0.00001	0.00009	0.00012	0.00010	0.00003	0.02453	0.00000	0.00000	0.00000
8	0.04120	0.00008	0.00009	0.00006	0.00005	0.00009	0.00030	0.06233	0.00008	0.00007
9	0.00400	0.00029	0.01395	0.00302	0.00047	0.00230	0.00116	0.00137	0.17417	0.01388
10	0.00565	0.00051	0.00329	0.01061	0.00614	0.00879	0.00116	0.01787	0.00215	0.07194
11	0.00071	0.00023	0.00033	0.00026	0.00009	0.00033	0.00055	0.00970	0.00046	0.00051
12	0.03072	0.00507	0.00385	0.00293	0.00475	0.01437	0.00228	0.00482	0.00713	0.00876
13	0.03851	0.01413	0.01156	0.01324	0.06972	0.04343	0.00241	0.00537	0.00153	0.00987
14	0.00468	0.00122	0.00807	0.00400	0.00346	0.00512	0.00186	0.00778	0.00296	0.00755
15	0.00032	0.00040	0.04523	0.03525	0.05463	0.01676	0.00073	0.01204	0.00041	0.00272
16	0.00007	0.00342	0.00617	0.00707	0.03027	0.00296	0.01049	0.00017	0.00003	0.00237
17	0.00276	0.00020	0.05943	0.11681	0.13051	0.02078	0.01139	0.03893	0.00026	0.01551
18	0.01070	0.02814	0.01993	0.02515	0.01427	0.02550	0.01100	0.00238	0.00137	0.00378
19	0.00003	0.00000	0.00002	0.00003	0.00000	0.00003	0.00000	0.00000	0.00001	0.00000
20	0.00000	0.01036	0.01006	0.01582	0.00693	0.00556	0.00100	0.00000	0.00000	0.00026
21	0.00013	0.00086	0.02014	0.02857	0.03750	0.03442	0.02663	0.00008	0.00037	0.00032
22	0.00473	0.00055	0.00206	0.00211	0.00061	0.00192	0.06819	0.00015	0.00003	0.00024
23	0.00019	0.00019	0.00004	0.00002	0.00009	0.00006	0.00780	0.00002	0.00000	0.00007
24	0.00045	0.00219	0.00348	0.00625	0.01023	0.00691	0.00640	0.00037	0.00653	0.00150
25	0.00757	0.00336	0.00042	0.00298	0.00610	0.00330	0.00268	0.00931	0.00224	0.00992
26	0.00970	0.00144	0.01025	0.01051	0.01438	0.01035	0.00203	0.01265	0.00240	0.00455
27	0.00330	0.00172	0.00245	0.00157	0.00103	0.00227	0.00306	0.00145	0.00115	0.00112
28	0.00970	0.01422	0.00111	0.00071	0.00045	0.00100	0.00342	0.00658	0.00241	0.00652
29	0.04060	0.00735	0.03757	0.02451	0.04255	0.02473	0.00594	0.04583	0.01374	0.02109
30	0.00419	0.00442	0.04569	0.01798	0.01808	0.02685	0.01367	0.00190	0.00112	0.00189
31	0.00749	0.06800	0.00866	0.00535	0.00537	0.00802	0.00538	0.00739	0.00404	0.00699
32	0.00014	0.00027	0.00007	0.00004	0.00003	0.00006	0.00025	0.00021	0.00031	0.00031
33	0.00332	0.00182	0.00166	0.00075	0.00333	0.00199	0.00211	0.00326	0.00065	0.00211
34	0.01004	0.01304	0.02852	0.03706	0.02823	0.00711	0.01466	0.01976	0.00457	0.00676
35	0.00002	0.00008	0.00010	0.00006	0.00004	0.00010	0.00036	0.00012	0.00005	0.00006
36	0.01979	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
37	0.00056	0.00040	0.00043	0.00028	0.00016	0.00039	0.00085	0.00055	0.00055	0.00054
38	0.00022	0.00074	0.00027	0.00017	0.00010	0.00024	0.00144	0.00076	0.00053	0.00050

	21	22	23	24	25	26	27	28	29	30
1	0.00000	0.00000	0.00000	0.00005	0.00003	0.00000	0.00039	0.00024	0.00025	0.00131
2	0.00000	0.00000	0.00000	0.00001	0.00002	0.00000	0.00000	0.00238	0.00000	0.00000
3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
6	0.00003	0.00006	0.00010	0.00023	0.00686	0.00057	0.00506	0.00593	0.00097	0.00144
7	0.00000	0.00000	0.00002	0.00000	0.00001	0.00001	0.00001	0.00001	0.00005	0.00001
8	0.00003	0.00003	0.00000	0.00031	0.00131	0.00009	0.00010	0.00005	0.00088	0.07418
9	0.00053	0.00021	0.00759	0.00935	0.00305	0.00172	0.00068	0.00030	0.00340	0.00098
10	0.00182	0.00056	0.00254	0.00994	0.00069	0.00099	0.00045	0.00028	0.00896	0.00757
11	0.00070	0.00019	0.00035	0.00071	0.00275	0.00282	0.00549	0.00218	0.00865	0.00331
12	0.00113	0.00160	0.00121	0.00766	0.00100	0.00070	0.00002	0.00154	0.00069	0.00153
13	0.00044	0.00061	0.00135	0.00414	0.06994	0.06489	0.00114	0.05605	0.03784	0.01542
14	0.00169	0.00259	0.00492	0.01050	0.00213	0.00946	0.00026	0.00075	0.00426	0.00312
15	0.00114	0.00173	0.00260	0.00209	0.00041	0.00013	0.00002	0.00007	0.00069	0.00066
16	0.00365	0.00338	0.00977	0.01144	0.00177	0.00000	0.00023	0.00012	0.00003	0.00006
17	0.00568	0.00502	0.02640	0.01225	0.00352	0.00076	0.00000	0.00012	0.00054	0.00109
18	0.00213	0.00204	0.01429	0.00365	0.00654	0.00205	0.00000	0.00301	0.00332	0.00099
19	0.00130	0.00043	0.00273	0.00484	0.00009	0.00012	0.00179	0.00209	0.00320	0.00057
20	0.00424	0.00032	0.00128	0.00525	0.00219	0.00000	0.00000	0.00079	0.00000	0.00000
21	0.01961	0.00113	0.01090	0.00390	0.00129	0.00015	0.04000	0.00305	0.00057	0.00061
22	0.09540	0.09231	0.03138	0.04633	0.01167	0.00669	0.01517	0.00040	0.00279	0.00143
23	0.00000	0.00000	0.01061	0.00003	0.00424	0.00155	0.00008	0.00004	0.00019	0.00006
24	0.00237	0.00036	0.00243	0.04545	0.00231	0.00072	0.00177	0.00127	0.00352	0.00200
25	0.00068	0.00095	0.00216	0.00341	0.05435	0.00666	0.00205	0.00352	0.00991	0.00238
26	0.00057	0.00066	0.00171	0.00341	0.00690	0.12387	0.00116	0.00345	0.02796	0.00811
27	0.00062	0.00054	0.00053	0.00217	0.00611	0.01616	0.01464	0.00361	0.03552	0.01117
28	0.00077	0.00103	0.00131	0.00239	0.00858	0.00095	0.00695	0.18678	0.01416	0.03019
29	0.00417	0.00323	0.01316	0.01509	0.01277	0.02900	0.00201	0.00777	0.03695	0.04058
30	0.00143	0.00111	0.00211	0.00335	0.00786	0.01509	0.00493	0.00279	0.04271	0.00694
31	0.00217	0.00232	0.00155	0.00777	0.02772	0.02610	0.02906	0.01488	0.05492	0.08821
32	0.00022	0.00036	0.00026	0.00051	0.00015	0.00006	0.00093	0.00021	0.00375	0.00008
33	0.00065	0.00061	0.00138	0.00176	0.00556	0.03071	0.00469	0.00471	0.03299	0.01078
34	0.00326	0.00270	0.00387	0.01259	0.02137	0.02183	0.02537	0.00973	0.08172	0.05194
35	0.00066	0.00003	0.00005	0.00013	0.00046	0.00010	0.03334	0.00013	0.00051	0.00492
36	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000
37	0.00023	0.00024	0.00022	0.00145	0.00109	0.00111	0.00121	0.00038	0.00430	0.00348
38	0.00021	0.00012	0.00026	0.00075	0.00171	0.00229	0.00367	0.00251	0.00668	0.00657

TTT

INPUT/OUTPUT INTERMEDIATE INDUSTRY REGIONAL FLOW TABLE-1980

	31	32	33	34	35	36	37	38
1	0.00052	0.00074	0.00000	0.00001	0.00352	0.00017	0.00035	0.00122
2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00001
3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
6	0.00904	0.00563	0.00062	0.00065	0.00174	0.00115	0.00399	0.02693
7	0.00001	0.00005	0.00000	0.00041	0.00003	0.00001	0.00004	0.00001
8	0.00017	0.00284	0.00005	0.00018	0.00074	0.00442	0.00268	0.00139
9	0.00057	0.02100	0.01290	0.00070	0.00187	0.00570	0.00169	0.00625
10	0.00101	0.00505	0.00170	0.00169	0.00028	0.00089	0.00157	0.00129
11	0.01061	0.01451	0.00083	0.01124	0.00459	0.00332	0.03503	0.01032
12	0.00020	0.00698	0.00434	0.00281	0.00085	0.01079	0.00177	0.01225
13	0.00049	0.03022	0.01048	0.00966	0.00312	0.00433	0.01475	0.03729
14	0.00111	0.00651	0.00688	0.00305	0.00184	0.00366	0.00102	0.00181
15	0.00002	0.00224	0.00332	0.00067	0.00004	0.00056	0.00072	0.00054
16	0.00000	0.00001	0.00006	0.00008	0.00000	0.00000	0.00011	0.00020
17	0.00000	0.00136	0.00961	0.00407	0.00008	0.00026	0.00221	0.00199
18	0.00019	0.00010	0.01923	0.00742	0.00068	0.00005	0.00050	0.00445
19	0.00251	0.00024	0.01664	0.01560	0.00000	0.00037	0.00386	0.00221
20	0.00000	0.00000	0.00149	0.00453	0.00000	0.00000	0.00000	0.00320
21	0.00031	0.00184	0.00778	0.00051	0.00061	0.00058	0.00214	0.00264
22	0.00090	0.00046	0.02792	0.01423	0.00032	0.00022	0.00450	0.00690
23	0.00003	0.00007	0.01307	0.00023	0.00010	0.00003	0.00003	0.00099
24	0.00132	0.00851	0.01775	0.01448	0.01283	0.01921	0.01035	0.00282
25	0.00106	0.00319	0.00229	0.00849	0.00140	0.00224	0.00326	0.02983
26	0.00133	0.00332	0.00222	0.00359	0.00229	0.00160	0.00401	0.02971
27	0.00922	0.00404	0.00586	0.01368	0.00385	0.00314	0.01113	0.00633
28	0.00677	0.05647	0.00371	0.00375	0.00669	0.00693	0.02411	0.08508
29	0.00307	0.01200	0.02116	0.00768	0.00872	0.00859	0.00670	0.00900
30	0.00940	0.01019	0.00633	0.01029	0.01484	0.00523	0.02074	0.00809
31	0.12449	0.15641	0.02193	0.03423	0.04287	0.02242	0.06735	0.03122
32	0.00024	0.00009	0.00011	0.00306	0.00021	0.00043	0.00034	0.00010
33	0.00350	0.02943	0.00956	0.00801	0.00577	0.00526	0.00426	0.00621
34	0.02610	0.05407	0.01287	0.04012	0.02593	0.01281	0.03144	0.02825
35	0.00021	0.00013	0.00005	0.00199	0.10744	0.00014	0.00474	0.00067
36	0.00384	0.00000	0.00000	0.00000	0.00000	0.05029	0.00000	0.00118
37	0.00185	0.00196	0.00061	0.00186	0.00163	0.00072	0.00689	0.00059
38	0.00773	0.00555	0.00080	0.00522	0.00122	0.00235	0.00924	0.00219

IV

TABLE 4

$(I-R)^{-1}$

INPUT/OUTPUT INTERMEDIATE INDUSTRY REGIONAL FLOW TABLE-1980

Direct and Indirect Requirements

	1	2	3	4	5	6	7	8	9	10
1	1.07195	0.00012	0.00072	0.00030	0.00029	0.00022	0.00013	0.04707	0.00113	0.00012
2	0.00072	1.00120	0.00041	0.00043	0.00159	0.00064	0.00006	0.00024	0.00006	0.00023
3	0.0	0.0	1.00000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	1.00000	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	1.00000	0.0	0.0	0.0	0.0	0.0
6	0.00320	0.00647	0.00067	0.00066	0.00098	1.00065	0.00065	0.00115	0.00034	0.00094
7	0.00002	0.00002	0.00011	0.00015	0.00012	0.00004	1.02515	0.00002	0.00001	0.00001
8	0.04944	0.00073	0.00441	0.00202	0.00219	0.00271	0.00166	1.09258	0.00047	0.00057
9	0.00054	0.00082	0.01957	0.00520	0.00251	0.00395	0.00206	0.00363	1.21141	0.01887
10	0.00700	0.00132	0.07130	0.01434	0.01061	0.01143	0.00217	0.02349	0.00336	1.07050
11	0.00394	0.00213	0.00276	0.00279	0.00305	0.00177	0.00149	0.01349	0.00116	0.00155
12	0.04657	0.00672	0.00644	0.00696	0.01090	0.01863	0.00378	0.01016	0.01028	0.01204
13	0.05402	0.02006	0.02172	0.02172	0.08742	0.05398	0.00547	0.01644	0.00442	0.01620
14	0.00740	0.00204	0.01129	0.00678	0.00691	0.00702	0.00296	0.01076	0.00425	0.00931
15	0.00100	0.00060	0.04926	0.03667	0.05969	0.01854	0.00130	0.01462	0.00066	0.00344
16	0.00133	0.00537	0.01428	0.02111	0.04752	0.00748	0.01391	0.00504	0.00035	0.00480
17	0.00730	0.00794	0.06010	0.12553	0.14113	0.03275	0.01413	0.04643	0.00096	0.01853
18	0.01413	0.03101	0.02525	0.03210	0.02245	0.02927	0.01369	0.00597	0.00288	0.00571
19	0.00141	0.00106	0.00166	0.00178	0.00226	0.00095	0.00096	0.00129	0.00043	0.00063
20	0.00064	0.01161	0.01217	0.01687	0.00978	0.00713	0.00277	0.00082	0.00019	0.00075
21	0.00092	0.00155	0.02139	0.02992	0.03927	0.03567	0.02867	0.00069	0.00068	0.00071
22	0.00741	0.00214	0.00756	0.00604	0.00774	0.00756	0.00159	0.00221	0.00104	0.00132
23	0.00042	0.00029	0.00025	0.00019	0.00035	0.00021	0.00623	0.00026	0.00006	0.00021
24	0.00237	0.00322	0.00584	0.00867	0.01322	0.00844	0.00772	0.00203	0.00867	0.00252
25	0.01274	0.00510	0.01194	0.00603	0.01438	0.00710	0.00436	0.01438	0.00366	0.01300
26	0.01622	0.00299	0.01721	0.01646	0.02302	0.01495	0.00364	0.01998	0.00433	0.00738
27	0.00009	0.00362	0.00667	0.00493	0.00551	0.00491	0.00447	0.00551	0.00254	0.00298
28	0.01049	0.02012	0.00878	0.00670	0.00936	0.00599	0.00660	0.01337	0.00481	0.01087
29	0.06040	0.01036	0.04919	0.03447	0.05590	0.03151	0.00967	0.05929	0.01852	0.02632
30	0.00920	0.00676	0.05027	0.02174	0.02328	0.02981	0.01544	0.00654	0.00267	0.00408
31	0.09331	0.10472	0.02472	0.01720	0.02053	0.01830	0.01110	0.02239	0.00858	0.01342
32	0.00050	0.00044	0.00054	0.00049	0.00059	0.00033	0.00043	0.00067	0.00050	0.00053
33	0.00751	0.00320	0.00584	0.00383	0.00759	0.00450	0.00330	0.00720	0.00184	0.00391
34	0.02527	0.02020	0.04197	0.04760	0.04260	0.01586	0.01967	0.03244	0.00691	0.01259
35	0.00055	0.00037	0.00082	0.00055	0.00057	0.00055	0.00067	0.00054	0.00022	0.00028
36	0.02212	0.00043	0.00012	0.00008	0.00009	0.00008	0.00005	0.00108	0.00006	0.00006
37	0.00133	0.00076	0.00125	0.00095	0.00103	0.00089	0.00114	0.00121	0.00064	0.00088
38	0.00194	0.00193	0.00108	0.00124	0.00140	0.00111	0.00198	0.00194	0.00098	0.00108

	11	12	13	14	15	16	17	18	19	20
1	0.00011	0.00043	0.00007	0.00037	0.00015	0.00013	0.00015	0.00004	0.00002	0.00004
2	0.00009	0.00070	0.00181	0.00019	0.00172	0.00045	0.00022	0.00009	0.00002	0.00006
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.00105	0.00190	0.00277	0.00103	0.00192	0.00249	0.00124	0.00041	0.00015	0.00031
7	0.00002	0.00004	0.00001	0.00002	0.00002	0.00002	0.00002	0.00001	0.00000	0.00001
8	0.00093	0.00499	0.00076	0.00018	0.00098	0.00086	0.00089	0.00041	0.00027	0.00036
9	0.00309	0.00242	0.00097	0.03786	0.00652	0.00254	0.00365	0.00137	0.00022	0.00077
10	0.04910	0.01106	0.00352	0.01194	0.01989	0.00618	0.00928	0.00200	0.00060	0.00251
11	1.03615	0.00525	0.00092	0.00200	0.00250	0.00284	0.00946	0.00088	0.00068	0.00070
12	0.00726	1.12345	0.01719	0.05913	0.01968	0.01694	0.01358	0.00225	0.00056	0.00322
13	0.00074	0.02564	1.12013	0.01014	0.02505	0.01821	0.01311	0.00662	0.00113	0.00413
14	0.00355	0.01543	0.00173	1.04403	0.01176	0.00441	0.00947	0.00416	0.00144	0.00270
15	0.00070	0.00528	0.00201	0.00336	1.06762	0.00528	0.00550	0.00181	0.00026	0.00078
16	0.00109	0.00404	0.00176	0.00393	0.00383	1.08254	0.10289	0.02241	0.00224	0.01778
17	0.00256	0.02152	0.00976	0.01479	0.01092	0.02189	1.05497	0.01495	0.00459	0.00970
18	0.00351	0.01225	0.00305	0.00959	0.00972	0.04243	0.03171	1.05893	0.00204	0.00902
19	0.00099	0.00162	0.00051	0.00067	0.00098	0.01705	0.00241	0.00090	1.27119	0.00165
20	0.00057	0.00069	0.00047	0.00058	0.00167	0.00762	0.01044	0.02496	0.00610	1.04044
21	0.00071	0.00090	0.00052	0.00180	0.00268	0.00524	0.00166	0.00114	0.00160	0.00424
22	0.00163	0.00219	0.00107	0.00163	0.00222	0.00391	0.00324	0.00797	0.07228	0.01560
23	0.00014	0.00021	0.00017	0.00024	0.00031	0.00033	0.00034	0.00034	0.00002	0.00007
24	0.01118	0.00419	0.00164	0.00705	0.00571	0.00499	0.00517	0.00311	0.00111	0.00266
25	0.01178	0.01602	0.02706	0.01280	0.02467	0.02871	0.01634	0.00350	0.00145	0.00289
26	0.00566	0.01180	0.00677	0.00925	0.03626	0.01331	0.01045	0.00309	0.00067	0.00268
27	0.00697	0.00567	0.00258	0.00425	0.00518	0.00502	0.00517	0.00240	0.00099	0.00211
28	0.00626	0.02785	0.01736	0.01256	0.03263	0.03328	0.01523	0.00457	0.00116	0.00367
29	0.01752	0.02836	0.00932	0.02465	0.02770	0.04737	0.03586	0.01429	0.00456	0.00923
30	0.00219	0.01077	0.00312	0.00575	0.00708	0.00700	0.00723	0.00332	0.00242	0.00305
31	0.02697	0.03018	0.01465	0.01618	0.02306	0.01649	0.02203	0.00763	0.00623	0.00652
32	0.00201	0.00114	0.00015	0.00099	0.00073	0.00103	0.00104	0.00027	0.00017	0.00047
33	0.00505	0.00550	0.00158	0.00371	0.00612	0.00431	0.00449	0.00175	0.00089	0.00327
34	0.02597	0.05388	0.01437	0.02068	0.02134	0.02154	0.02140	0.00797	0.00312	0.00686
35	0.00064	0.00069	0.00027	0.00037	0.00049	0.00047	0.00044	0.00025	0.00016	0.00018
36	0.00013	0.00014	0.00006	0.00008	0.00010	0.00007	0.00010	0.00003	0.00003	0.00003
37	0.00139	0.00186	0.00042	0.00163	0.00137	0.00146	0.00181	0.00053	0.00024	0.00049
38	0.00042	0.00229	0.00108	0.00147	0.00164	0.00212	0.00159	0.00067	0.00026	0.00049

VI

INPUT/OUTPUT INTERMEDIATE INDUSTRY REGIONAL FLOW TABLE-1980

	21	22	23	24	25	26	27	28	29	30
1	0.00003	0.00002	0.00005	0.00014	0.00021	0.00018	0.00064	0.00038	0.00067	0.00510
2	0.00002	0.00003	0.00006	0.00012	0.00097	0.00094	0.00007	0.00377	0.00063	0.00039
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.00018	0.00017	0.00031	0.00064	0.00813	0.00172	0.00587	0.00796	0.00287	0.00341
7	0.00001	0.00001	0.00002	0.00001	0.00002	0.00003	0.00003	0.00002	0.00009	0.00004
8	0.00025	0.00021	0.00041	0.00096	0.00249	0.00200	0.00079	0.00059	0.00515	0.08224
9	0.00097	0.00052	0.00591	0.01268	0.00459	0.00394	0.00135	0.00092	0.00607	0.00260
10	0.00242	0.00097	0.00359	0.01221	0.00196	0.00274	0.00132	0.00122	0.01207	0.01138
11	0.00118	0.00049	0.00107	0.00180	0.00454	0.00530	0.00741	0.00377	0.01319	0.00780
12	0.00199	0.00275	0.00266	0.01102	0.00336	0.00359	0.00077	0.00386	0.00333	0.00408
13	0.00155	0.00165	0.00384	0.00821	0.08682	0.08775	0.00420	0.07987	0.05360	0.02713
14	0.00258	0.00321	0.00599	0.01246	0.00323	0.01233	0.00092	0.00154	0.00644	0.00525
15	0.00156	0.00214	0.00321	0.00280	0.00099	0.00069	0.00033	0.00049	0.00139	0.00216
16	0.00530	0.00471	0.01412	0.01496	0.00307	0.00062	0.00071	0.00060	0.00076	0.00092
17	0.00709	0.00615	0.02924	0.01513	0.00584	0.00290	0.00100	0.00156	0.00298	0.00593
18	0.00314	0.00269	0.01704	0.00588	0.00677	0.00436	0.00094	0.00495	0.00616	0.00315
19	0.00211	0.00083	0.00409	0.00733	0.00126	0.00220	0.00338	0.00397	0.00772	0.00324
20	0.00476	0.00056	0.00223	0.00627	0.00296	0.00048	0.00048	0.00141	0.00090	0.00063
21	1.02223	0.00139	0.01155	0.00465	0.00234	0.00164	0.04189	0.00451	0.00307	0.00188
22	0.10781	1.10213	0.03711	0.05757	0.01551	0.01147	0.02265	0.00227	0.00862	0.00465
23	0.00003	0.00003	1.01079	0.00013	0.00468	0.00237	0.00020	0.00020	0.00088	0.00036
24	0.00204	0.00064	0.00323	1.04654	0.00372	0.00277	0.00340	0.00242	0.00700	0.00434
25	0.00161	0.00160	0.00373	0.00566	1.06070	0.01160	0.00322	0.00721	0.01475	0.00641
26	0.00120	0.00129	0.00332	0.00575	0.01020	1.14412	0.00233	0.00624	0.03579	0.01377
27	0.00117	0.00099	0.00166	0.00390	0.00863	0.02185	1.01635	0.00587	0.04177	0.01622
28	0.00165	0.00208	0.00339	0.00555	0.01449	0.00593	0.01073	1.23237	0.02458	0.04267
29	0.00580	0.00456	0.01664	0.01976	0.01735	0.03841	0.00437	0.01209	1.04592	0.05035
30	0.00212	0.00166	0.00348	0.00538	0.01071	0.02071	0.00705	0.00513	0.04865	1.01224
31	0.00425	0.00415	0.00507	0.01404	0.03972	0.04391	0.03940	0.02542	0.08175	0.11309
32	0.00032	0.00044	0.00041	0.00075	0.00038	0.00040	0.00111	0.00040	0.00435	0.00059
33	0.00102	0.00010	0.00243	0.00329	0.00765	0.03780	0.00596	0.00695	0.03837	0.01492
34	0.00511	0.00427	0.00735	0.01832	0.02929	0.03485	0.03095	0.01654	0.09932	0.06723
35	0.00015	0.00010	0.00019	0.00041	0.00104	0.00120	0.03610	0.00051	0.00274	0.00645
36	0.00002	0.00002	0.00002	0.00006	0.00017	0.00030	0.00018	0.00012	0.00036	0.00058
37	0.00035	0.00035	0.00044	0.00182	0.00151	0.00179	0.00153	0.00070	0.00527	0.00429
38	0.00039	0.00027	0.00058	0.00132	0.00269	0.00381	0.00446	0.00364	0.00904	0.00866

INPUT/OUTPUT INTERMEDIATE INDUSTRY REGIONAL FLOW TABLE-1980

	31	32	33	34	35	36	37	38
1	0.00075	0.00119	0.00011	0.00016	0.00441	0.00050	0.00075	0.00153
2	0.00015	0.00065	0.00019	0.00018	0.00011	0.00012	0.00033	0.00089
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.01157	0.00846	0.00121	0.00163	0.00284	0.00180	0.00563	0.02865
7	0.00003	0.00009	0.00002	0.00044	0.00005	0.00002	0.00006	0.00003
8	0.00133	0.00458	0.00090	0.00137	0.00270	0.00580	0.00502	0.00279
9	0.00105	0.02704	0.01681	0.00183	0.00324	0.00805	0.00292	0.00860
10	0.00242	0.00780	0.00309	0.00332	0.00148	0.00210	0.00452	0.00331
11	0.01442	0.01973	0.00213	0.01402	0.00721	0.00484	0.04056	0.01322
12	0.00139	0.01053	0.00651	0.00448	0.00213	0.01377	0.00358	0.01623
13	0.01101	0.04438	0.01534	0.01510	0.00766	0.00817	0.02287	0.05766
14	0.00160	0.00843	0.00839	0.00419	0.00292	0.00487	0.00212	0.00350
15	0.00036	0.00306	0.00401	0.00107	0.00031	0.00096	0.00119	0.00151
16	0.00027	0.00077	0.00236	0.00130	0.00041	0.00052	0.00083	0.00129
17	0.00107	0.00373	0.01216	0.00571	0.00104	0.00153	0.00374	0.00478
18	0.00125	0.00262	0.02198	0.00921	0.00174	0.00092	0.00189	0.00740
19	0.00468	0.00349	0.02484	0.02145	0.00134	0.00137	0.00650	0.00443
20	0.00038	0.00073	0.00261	0.00549	0.00038	0.00031	0.00052	0.00417
21	0.00144	0.00329	0.00884	0.00162	0.00133	0.00114	0.00334	0.00473
22	0.00267	0.00450	0.03583	0.01982	0.00268	0.00241	0.00790	0.01082
23	0.00014	0.00058	0.01341	0.00045	0.00026	0.00016	0.00019	0.00137
24	0.00276	0.01176	0.01976	0.01670	0.01618	0.02197	0.01264	0.00480
25	0.00271	0.00699	0.00420	0.01085	0.00292	0.00375	0.00598	0.03507
26	0.00299	0.00675	0.00442	0.00571	0.00429	0.00319	0.00673	0.03671
27	0.01199	0.00866	0.00799	0.01610	0.00648	0.00477	0.01416	0.00973
28	0.01194	0.07489	0.00709	0.00786	0.01170	0.01100	0.03412	0.10847
29	0.00594	0.01855	0.02545	0.01149	0.01302	0.01185	0.01133	0.01567
30	0.01234	0.01499	0.00871	0.01270	0.01879	0.00710	0.02389	0.01218
31	1.14700	0.18926	0.03073	0.04665	0.06107	0.03110	0.08627	0.04630
32	0.00040	1.00052	0.00035	0.00334	0.00045	0.00061	0.00065	0.00039
33	0.00516	0.03266	1.01134	0.00964	0.00806	0.00671	0.00640	0.00959
34	0.03665	0.06839	0.01922	1.04757	0.03566	0.01838	0.04101	0.03825
35	0.00091	0.00081	0.00050	0.00306	1.12084	0.00046	0.00616	0.00136
36	0.00467	0.00060	0.00013	0.00020	0.00034	1.05310	0.00038	0.00147
37	0.00236	0.00278	0.00099	0.00228	0.00222	0.00103	1.00746	0.00110
38	0.00943	0.00811	0.00155	0.00629	0.00241	0.00314	0.01089	1.00357

VIII

TABLE 5

Direct, Indirect and Induced Requirement Matrix

	1	2	3	4	5	6	7	8	9	10
1	1.08266	0.00808	0.01015	0.00907	0.01033	0.01212	0.00983	0.05503	0.00940	0.00868
2	0.00191	1.00209	0.00145	0.00140	0.00271	0.00216	0.00116	0.00112	0.00098	0.00120
3	0.0	0.0	1.00000	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	1.00000	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	1.00000	0.0	0.0	0.0	0.0	0.0
6	0.01913	0.01824	0.01483	0.01365	0.01583	1.01825	0.01520	0.01292	0.01257	0.01390
7	0.00056	0.00043	0.00066	0.00061	0.00065	0.00066	1.02566	0.00044	0.00044	0.00047
8	0.11079	0.05069	0.06363	0.05711	0.06519	0.07736	0.06257	1.14253	0.05240	0.05555
9	0.02646	0.01709	0.03686	0.02315	0.02304	0.02827	0.02190	0.01990	1.22832	0.03678
10	0.03072	0.01897	0.09215	0.03374	0.03279	0.03773	0.02362	0.04106	0.02166	1.09786
11	0.03004	0.02193	0.02626	0.02464	0.02803	0.03136	0.02564	0.03330	0.02175	0.02334
12	0.03020	0.01540	0.01673	0.01654	0.02165	0.03161	0.01437	0.01884	0.01931	0.02160
13	0.13604	0.08240	0.09579	0.09046	0.16603	0.14715	0.08147	0.07876	0.06920	0.08480
14	0.01446	0.00726	0.01749	0.01256	0.01351	0.01485	0.00934	0.01599	0.00969	0.01507
15	0.00937	0.00656	0.05609	0.04503	0.06696	0.02715	0.00832	0.02038	0.00667	0.00979
16	0.00269	0.00653	0.01566	0.02239	0.04898	0.00921	0.01532	0.00619	0.00156	0.00607
17	0.01449	0.01323	0.07236	0.15136	0.14780	0.04066	0.02056	0.05172	0.00646	0.02435
18	0.01910	0.03470	0.02962	0.03617	0.02710	0.03478	0.01816	0.00966	0.00671	0.00977
19	0.00709	0.00527	0.00667	0.00643	0.00758	0.00724	0.00611	0.00551	0.00481	0.00527
20	0.00166	0.01273	0.01326	0.01969	0.01095	0.00851	0.00389	0.00174	0.00115	0.00176
21	0.00625	0.00556	0.02606	0.03428	0.04426	0.04158	0.03350	0.00465	0.00480	0.00507
22	0.01601	0.00897	0.01565	0.01557	0.01635	0.01776	0.06991	0.00903	0.00813	0.00883
23	0.00551	0.00391	0.00454	0.00418	0.00492	0.00562	0.01264	0.00388	0.00383	0.00419
24	0.01404	0.01106	0.01606	0.01820	0.02412	0.02136	0.01825	0.01067	0.01765	0.01203
25	0.06456	0.04360	0.05751	0.05042	0.06266	0.06456	0.05123	0.05281	0.04363	0.05531
26	0.03266	0.01534	0.03184	0.03009	0.03859	0.03340	0.01870	0.03233	0.01716	0.02096
27	0.05595	0.03930	0.04873	0.04406	0.05027	0.05795	0.04774	0.04099	0.03942	0.04203
28	0.11321	0.09037	0.09207	0.08419	0.09798	0.11102	0.09228	0.08362	0.07785	0.08819
29	0.16035	0.09045	0.14411	0.12278	0.15690	0.15121	0.10731	0.13935	0.10176	0.11445
30	0.32409	0.23997	0.32673	0.27896	0.31743	0.37843	0.29962	0.23974	0.24510	0.26076
31	0.48469	0.39562	0.36886	0.33738	0.38669	0.45227	0.36509	0.31267	0.31035	0.33294
32	0.00447	0.00333	0.00398	0.00366	0.00423	0.00464	0.00395	0.00355	0.00350	0.00371
33	0.04140	0.02640	0.03571	0.03163	0.03938	0.04217	0.03402	0.03246	0.02803	0.03164
34	0.09266	0.07041	0.10143	0.10312	0.10586	0.09084	0.08083	0.08259	0.06105	0.06779
35	0.02217	0.01641	0.01983	0.01824	0.02080	0.02453	0.02023	0.01658	0.01689	0.01793
36	0.24915	0.16836	0.19922	0.18531	0.21193	0.25115	0.20485	0.16901	0.17465	0.18491
37	0.02349	0.01722	0.02073	0.01908	0.02176	0.02546	0.02118	0.01764	0.01793	0.01897
38	0.03169	0.02414	0.02801	0.02574	0.02948	0.03432	0.02906	0.02415	0.02407	0.02553
39	1.28123	0.95034	1.12659	1.04815	1.19866	1.42005	1.15884	0.95027	0.98789	1.04598

IX

	11	12	13	14	15	16	17	18	19	20
1	0.01093	0.00719	0.00332	0.00940	0.01022	0.00827	0.00891	0.00756	0.01111	0.00739
2	0.00129	0.00145	0.01217	0.00119	0.00284	0.00135	0.00119	0.00092	0.00125	0.00087
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.01705	0.01119	0.00758	0.01439	0.01681	0.01453	0.01420	0.01153	0.01655	0.01119
7	0.00059	0.00040	0.00018	0.00050	0.00054	0.00044	0.00046	0.00040	0.00058	0.00039
8	0.06663	0.04741	0.02119	0.06287	0.06417	0.05196	0.05586	0.04761	0.06987	0.04652
9	0.02561	0.01624	0.00762	0.05632	0.02710	0.01919	0.02156	0.01674	0.02289	0.01580
10	0.07301	0.02600	0.01071	0.03191	0.04251	0.02418	0.02664	0.01862	0.02511	0.01876
11	1.11507	0.02206	0.00902	0.02448	0.02755	0.02310	0.03126	0.01960	0.02628	0.01900
12	0.01907	1.13085	0.02074	0.06698	0.03086	0.02582	0.02314	0.01045	0.01266	0.01125
13	0.09140	0.07857	1.14560	0.06087	0.10390	0.08197	0.08172	0.06550	0.08797	0.06172
14	0.01047	0.01988	0.00387	1.04597	0.01841	0.00977	0.01524	0.00911	0.00873	0.00754
15	0.00654	0.01017	0.00436	0.00992	1.07511	0.01117	0.01185	0.00725	0.00829	0.00611
16	0.00267	0.00502	0.00228	0.00524	0.00529	1.08373	0.10416	0.02350	0.00385	0.01884
17	0.00913	0.02601	0.01192	0.02079	0.01761	0.02730	1.06079	0.01995	0.01196	0.01458
18	0.00652	0.01538	0.00455	0.01377	0.01436	0.04620	0.03577	1.06241	0.00718	0.01243
19	0.00072	0.00520	0.00223	0.00565	0.00631	0.02140	0.00705	0.00488	1.27706	0.00555
20	0.00102	0.00167	0.00085	0.00163	0.00283	0.00856	0.01145	0.02583	0.00738	1.04129
21	0.00009	0.00426	0.00214	0.00629	0.00768	0.00929	0.00601	0.00487	0.00711	0.00790
22	0.01111	0.00799	0.00386	0.00937	0.01086	0.01089	0.01075	0.01441	0.08179	0.02191
23	0.00501	0.00329	0.00165	0.00435	0.00489	0.00404	0.00433	0.00377	0.00507	0.00342
24	0.02292	0.01153	0.00517	0.01666	0.01664	0.01383	0.01468	0.01127	0.01315	0.01064
25	0.06403	0.05065	0.04276	0.05042	0.07350	0.06803	0.05865	0.03962	0.05501	0.03840
26	0.02204	0.02228	0.01101	0.02326	0.05188	0.02594	0.02404	0.01475	0.01787	0.01409
27	0.05520	0.03579	0.01688	0.04452	0.05007	0.04132	0.04423	0.03592	0.05043	0.03490
28	0.10177	0.06751	0.04607	0.09229	0.12171	0.10516	0.09257	0.07095	0.09905	0.06859
29	0.12650	0.09635	0.04204	0.11552	0.12900	0.12929	0.12401	0.08994	0.11613	0.08321
30	0.32520	0.20680	0.09841	0.27041	0.30212	0.24559	0.26396	0.22365	0.32736	0.21854
31	0.42517	0.27668	0.13327	0.34563	0.39033	0.31348	0.34161	0.28189	0.41072	0.27476
32	0.00593	0.00359	0.00133	0.00427	0.00438	0.00398	0.00422	0.00300	0.00419	0.00314
33	0.03790	0.02690	0.01168	0.03230	0.03800	0.03009	0.03223	0.02555	0.03600	0.02655
34	0.09215	0.09647	0.05487	0.07760	0.08479	0.07285	0.07662	0.05535	0.07300	0.05320
35	0.02245	0.01431	0.00662	0.01858	0.02078	0.01688	0.01810	0.01540	0.02251	0.01500
36	0.22892	0.14279	0.06869	0.19067	0.21258	0.17190	0.18498	0.15871	0.23404	0.15522
37	0.02374	0.01581	0.00714	0.02028	0.02216	0.01828	0.01990	0.01606	0.02314	0.01568
38	0.03062	0.02115	0.01015	0.02668	0.02974	0.02484	0.02604	0.02165	0.03121	0.02102
39	1.29160	0.80697	0.35632	1.07849	1.20231	0.97225	1.04616	0.89784	1.32416	0.87812

X

INPUT/OUTPUT INTERMEDIATE INDUSTRY REGIONAL FLOW TABLE-1980

	21	22	23	24	25	26	27	28	29	30
1	0.00895	0.00956	0.00527	0.01049	0.01189	0.01158	0.01154	0.00576	0.01407	0.01811
2	0.00102	0.00109	0.00064	0.00127	0.00227	0.00221	0.00126	0.00437	0.00211	0.00184
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.01330	0.01428	0.00604	0.01994	0.02541	0.01858	0.02200	0.01593	0.02268	0.02266
7	0.00047	0.00050	0.00029	0.00055	0.00063	0.00062	0.00060	0.00030	0.00079	0.00072
8	0.05028	0.06008	0.03321	0.06589	0.07585	0.07355	0.06924	0.03441	0.08924	0.16394
9	0.01922	0.02001	0.02059	0.03403	0.02849	0.02725	0.02365	0.01194	0.03347	0.02921
10	0.02215	0.02204	0.01514	0.03507	0.02779	0.02794	0.02542	0.01313	0.04168	0.04014
11	0.02340	0.02422	0.01407	0.02754	0.03362	0.03367	0.03455	0.01718	0.04653	0.04019
12	0.01115	0.01515	0.00838	0.02231	0.01611	0.01602	0.01267	0.00974	0.01795	0.01828
13	0.07147	0.07632	0.04476	0.08922	0.17834	0.17703	0.06960	0.12207	0.15851	0.12906
14	0.00640	0.00946	0.00943	0.01926	0.01092	0.01983	0.00810	0.00509	0.01525	0.01381
15	0.00505	0.00904	0.00699	0.01029	0.00946	0.00894	0.00823	0.00439	0.01109	0.01159
16	0.00659	0.00610	0.01488	0.01646	0.00477	0.00227	0.00230	0.00139	0.00271	0.00281
17	0.01302	0.01249	0.03271	0.02201	0.01360	0.01048	0.00825	0.00514	0.01189	0.01458
18	0.00727	0.00731	0.01947	0.01067	0.01415	0.00964	0.00599	0.00744	0.01237	0.00918
19	0.00685	0.00685	0.00685	0.01281	0.00745	0.00624	0.00915	0.00662	0.01481	0.01013
20	0.00519	0.00167	0.00285	0.00747	0.00432	0.00176	0.00174	0.00203	0.00245	0.00213
21	1.02472	0.00615	0.01415	0.00980	0.00815	0.00730	0.04732	0.00719	0.00973	0.00835
22	0.11540	1.11031	0.04159	0.06644	0.02553	0.02124	0.03201	0.00689	0.02011	0.01581
23	0.00410	0.00437	1.01317	0.00464	0.01000	0.00755	0.00517	0.00266	0.00698	0.00628
24	0.01233	0.01099	0.00590	1.05977	0.01640	0.01515	0.01523	0.00827	0.02154	0.01847
25	0.04472	0.04765	0.02297	0.05561	1.11714	0.06606	0.05589	0.03323	0.07945	0.06927
26	0.01511	0.01607	0.01142	0.02179	0.02833	1.16186	0.01924	0.01460	0.05657	0.03390
27	0.04697	0.04350	0.02496	0.05002	0.06073	0.07267	1.06490	0.02990	0.10150	0.07425
28	0.06060	0.08626	0.04952	0.09667	0.11765	0.10657	0.10699	1.27994	0.14285	0.15758
29	0.09561	0.10050	0.06922	0.12384	0.13494	0.15310	0.11409	0.06631	1.18072	0.18131
30	0.20570	0.22110	0.15060	0.30850	0.35317	0.35476	0.32659	0.16304	0.44124	1.39365
31	0.32960	0.35197	0.19567	0.39136	0.46600	0.45974	0.43710	0.22198	0.57043	0.58787
32	0.00350	0.00390	0.00231	0.00450	0.00461	0.00453	0.00507	0.00235	0.00921	0.00531
33	0.02900	0.03121	0.01697	0.03604	0.04465	0.07389	0.04046	0.02401	0.08079	0.05613
34	0.06157	0.06436	0.04028	0.08351	0.10293	0.10669	0.09967	0.05050	0.18374	0.14926
35	0.01814	0.01932	0.01072	0.02126	0.02460	0.02417	0.06008	0.01137	0.02974	0.03269
36	0.13640	0.20124	0.11029	0.21836	0.24679	0.24087	0.23030	0.11384	0.26308	0.27525
37	0.01679	0.02004	0.01123	0.02318	0.02564	0.02533	0.02405	0.01183	0.03294	0.03117
38	0.02550	0.02668	0.01517	0.03019	0.03530	0.03563	0.03489	0.01868	0.04643	0.04496
39	1.00595	1.13865	0.62596	1.23523	1.39550	1.36126	1.30215	0.64348	1.59976	1.55425

	31	32	33	34	35	36	37	38	39
1	0.01245	0.01195	0.01111	0.01212	0.01523	0.01611	0.01562	0.01725	0.02042
2	0.00145	0.00185	0.00141	0.00151	0.00131	0.00185	0.00198	0.00263	0.00227
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.02680	0.02435	0.01748	0.01933	0.01885	0.02490	0.02765	0.05191	0.03021
7	0.00064	0.00065	0.00059	0.00106	0.00051	0.00083	0.00084	0.00085	0.00107
8	0.07479	0.07200	0.06995	0.07645	0.07063	0.10382	0.09848	0.10149	0.12823
9	0.02497	0.04901	0.03930	0.02629	0.02537	0.03998	0.03337	0.04075	0.04177
10	0.02820	0.03154	0.02741	0.02976	0.02546	0.03662	0.03743	0.03806	0.04515
11	0.04354	0.04647	0.02951	0.04379	0.03413	0.04370	0.07702	0.05236	0.05084
12	0.01410	0.02225	0.01652	0.01754	0.01394	0.03081	0.01962	0.03339	0.02229
13	0.10520	0.12650	0.10149	0.10676	0.09241	0.13047	0.13948	0.18080	0.15998
14	0.00950	0.01550	0.01503	0.01206	0.01004	0.01515	0.01192	0.01385	0.01344
15	0.00600	0.01084	0.01198	0.00973	0.00815	0.01227	0.01198	0.01290	0.01479
16	0.00191	0.00235	0.00395	0.00504	0.00198	0.00279	0.00300	0.00357	0.00297
17	0.00805	0.01087	0.01947	0.01566	0.00824	0.01190	0.01364	0.01523	0.01357
18	0.00607	0.00760	0.02707	0.01475	0.00676	0.00815	0.00679	0.01466	0.00946
19	0.01007	0.00917	0.03067	0.02778	0.00706	0.00963	0.01438	0.01275	0.01081
20	0.00174	0.00190	0.00389	0.00687	0.00163	0.00211	0.00224	0.00599	0.00236
21	0.00720	0.00805	0.01431	0.00757	0.00671	0.00890	0.01075	0.01255	0.01016
22	0.01291	0.01371	0.04526	0.03008	0.01196	0.01580	0.02067	0.02430	0.01752
23	0.00547	0.00547	0.01842	0.00690	0.00518	0.00726	0.00697	0.00852	0.00930
24	0.01548	0.02342	0.03170	0.02969	0.02792	0.03892	0.02680	0.02187	0.02217
25	0.05923	0.05887	0.05733	0.06863	0.05519	0.07917	0.07790	0.11101	0.09866
26	0.02115	0.02341	0.02146	0.02427	0.02107	0.02741	0.02982	0.06110	0.03169
27	0.06417	0.05657	0.05703	0.06943	0.05473	0.07439	0.08055	0.07984	0.09108
28	0.11520	0.16972	0.10419	0.11347	0.10724	0.14886	0.16557	0.24729	0.18035
29	0.12509	0.12003	0.13613	0.13185	0.12191	0.16897	0.16115	0.17389	0.20554
30	0.33520	0.32970	0.33105	0.36324	0.33592	0.46473	0.46023	0.47298	0.59864
31	1.57454	0.56106	0.43197	0.48501	0.45564	0.60073	0.62943	0.61991	0.74518
32	0.00410	1.00442	0.00434	0.00768	0.00438	0.00627	0.00604	0.00609	0.00741
33	0.04224	0.06070	1.04017	0.04772	0.04232	0.05615	0.05355	0.05938	0.06468
34	0.11040	0.13605	0.06855	1.12296	0.10387	0.11677	0.13485	0.13735	0.12874
35	0.02450	0.02246	0.02267	0.02717	1.14266	0.03193	0.03617	0.03305	0.04117
36	0.25104	0.22749	0.25220	0.25265	0.22873	1.28265	0.31462	0.33333	0.43111
37	0.02652	0.02498	0.02571	0.02699	0.02457	0.03328	1.03821	0.03358	0.04219
38	0.04209	0.03809	0.03225	0.03967	0.03282	0.04673	0.05245	1.04746	0.05702
39	1.59740	1.60270	1.31553	1.42849	1.29232	1.66476	1.77810	1.67780	2.43944

XII

TABLE 6

INCOME MULTIPLIERS OF 1960 ABAG REGIONAL INPUT/OUTPUT MODEL

SECTOR NAME	OUTPUT MULTIPLIER	HOUSEHOLD ROW	DIRECT & INDIRECT	TYPE I MULTIPLIER	DIR. IND., INDUCED	TYPE II MULTIPLIER
	OPEN MODEL				CLOSED MODEL	
AGRICULTURE, FORESTRY, AND FISHERIES	1.5079	0.3317	0.5252	1.58	1.2812	3.86
MINING	1.2883	0.2857	0.3896	1.36	0.9503	3.33
CONSTRUCTION, RESIDENTIAL	1.5666	0.2608	0.4618	1.77	1.1266	4.32
CONSTRUCTION, NON-RESIDENTIAL	1.5107	0.2551	0.4297	1.68	1.0461	4.11
CONSTRUCTION, HIGHWAYS AND PUBLIC UTILITIES	1.6759	0.2761	0.4914	1.78	1.1967	4.34
MAINTENANCE AND REPAIR	1.3851	0.4579	0.5824	1.27	1.4266	3.10
ORDNANCE	1.3013	0.3041	0.4750	1.50	1.1588	3.18
FOOD AND BEVERAGES	1.4850	0.2281	0.3895	1.71	0.9503	4.17
TEXTILE AND APPAREL PRODUCTS	1.3113	0.3044	0.4050	1.33	0.9879	3.25
LUMBER, WOOD AND PAPER PRODUCTS AND FURNITURES	1.2743	0.3368	0.4268	1.27	1.0460	3.11
PRINTING AND PUBLISHING	1.3070	0.4100	0.5295	1.29	1.2918	3.15
CHEMICALS AND ALLIED PRODUCTS	1.4425	0.1935	0.3308	1.71	0.8070	4.17
PETROLEUM REFINING AND RELATED INDUSTRIES	1.2795	0.0921	0.1592	1.73	0.3883	4.22
RUBBER AND LEATHER PRODUCTS	1.3311	0.3356	0.4421	1.32	1.0765	3.21
STONE, CLAY, GLASS, AND CONCRETE PRODUCTS	1.3850	0.3623	0.4929	1.36	1.2023	3.32
PRIMARY METAL INDUSTRIES	1.4286	0.2590	0.3966	1.54	0.9723	3.75
FABRICATED METAL PRODUCTS	1.4226	0.2918	0.4289	1.47	1.0462	3.58
NON-ELECTRICAL MACHINERY, EXCEPT COMPUTERS	1.2050	0.3015	0.3681	1.22	0.8978	2.98
COMPUTERS AND OFFICE EQUIPMENT	1.3889	0.3909	0.5428	1.39	1.3242	3.39
ELECTRIC TRANSMISSION AND INDUSTRIAL APPARATUS	1.1587	0.3066	0.3600	1.17	0.8781	2.86
HOUSEHOLD APPLIANCES,LIGHTING EQUIPMENT,RADIO,T. V	1.1919	0.3633	0.4370	1.20	1.0659	2.93
ELECTRONIC COMPONENTS AND EQUIPMENT	1.1543	0.4072	0.4668	1.15	1.1586	2.80
TRANSPORTATION EQUIPMENT	1.2093	0.1843	0.2558	1.39	0.6240	3.39
PROFESSIONAL, SCIENTIFIC EQUIPMENT AND MISCELLANEO	1.3097	0.3933	0.5064	1.29	1.2352	3.14
TRANSPORTATION SERVICES	1.3700	0.4505	0.5721	1.27	1.3955	3.10
TRUCK TRANSPORTATION	1.5167	0.3777	0.5560	1.48	1.3613	3.60
COMMUNICATION	1.2641	0.4285	0.5338	1.25	1.3021	3.04
UTILITIES	1.4495	0.1621	0.2658	1.63	0.6435	3.97
WHOLESALE TRADE	1.5963	0.4269	0.6558	1.54	1.5998	3.75
RETAIL TRADE	1.5342	0.4457	0.6371	1.43	1.5543	3.49
F.I.R.E.	1.3171	0.4400	0.5729	1.30	1.3975	3.18
HOTELS AND LODGING PLACES	1.6017	0.3074	0.5258	1.71	1.2827	4.17
PERSONAL AND REPAIR SERVICES	1.3232	0.4223	0.5385	1.28	1.3135	3.11
BUSINESS AND PROFESSIONAL SERVICES	1.3135	0.4626	0.5856	1.27	1.4265	3.09
AMUSEMENT AND RECREATION SERVICES	1.3487	0.3914	0.5298	1.35	1.2923	3.30
HEALTH SERVICES	1.2375	0.6620	0.7644	1.15	1.8648	2.82
EDUCATION SERVICES ,NON-COMMERCIAL R & D,NON-PROFI	1.3825	0.5620	0.7289	1.25	1.7781	3.06
GOVERNMENT NOT ELSEWHERE CLASSIFIED	1.5015	0.6106	0.7698	1.26	1.8778	3.08

XIII

TABLE 7

EMPLOYMENT MULTIPLIERS OF 1980 ABAG REGIONAL INPUT-OUTPUT MODEL

SECTOR NAME	EMPT CHANGE PER_$1,000	DIRECT & INDIRECT	TYPE I DIR. IND.	INDUCED	TYPE II
AGRICULTURE, FORESTRY, AND FISHERIES	0.0515	0.0631	1.23	0.1064	2.07
MINING	0.0271	0.0318	1.17	0.0639	2.36
CONSTRUCTION, RESIDENTIAL	0.0139	0.0247	1.77	0.0628	4.51
CONSTRUCTION, NON-RESIDENTIAL	0.0254	0.0343	1.35	0.0696	2.75
CONSTRUCTION, HIGHWAYS AND PUBLIC UTILITIES	0.0210	0.0314	1.50	0.0720	3.43
MAINTENANCE AND REPAIR	0.0232	0.0299	1.29	0.0780	3.36
ORDNANCE	0.0129	0.0188	1.46	0.0580	4.50
FOOD AND BEVERAGES	0.0090	0.0184	2.06	0.0506	5.64
TEXTILE AND APPAREL PRODUCTS	0.0179	0.0237	1.32	0.0571	3.18
LUMBER, WOOD AND PAPER PRODUCTS AND FURNITURES	0.0122	0.0165	1.35	0.0519	4.26
PRINTING AND PUBLISHING	0.0181	0.0240	1.32	0.0677	3.73
CHEMICALS AND ALLIED PRODUCTS	0.0084	0.0154	1.84	0.0427	5.08
PETROLEUM REFINING AND RELATED INDUSTRIES	0.0009	0.0040	4.28	0.0171	18.29
RUBBER AND LEATHER PRODUCTS	0.0135	0.0189	1.40	0.0554	4.10
STONE, CLAY, GLASS, AND CONCRETE PRODUCTS	0.0067	0.0126	1.87	0.0532	7.91
PRIMARY METAL INDUSTRIES	0.0127	0.0199	1.57	0.0528	4.16
FABRICATED METAL PRODUCTS	0.0119	0.0189	1.58	0.0542	4.56
NON-ELECTRICAL MACHINERY, EXCEPT COMPUTERS	0.0200	0.0236	1.18	0.0540	2.70
COMPUTERS AND OFFICE EQUIPMENT	0.0141	0.0203	1.44	0.0651	4.61
ELECTRIC TRANSMISSION AND INDUSTRIAL APPARATUS	0.0152	0.0179	1.18	0.0476	3.14
HOUSEHOLD APPLIANCES,LIGHTING EQUIPMENT,RADIO,T. V	0.0167	0.0205	1.23	0.0566	3.38
ELECTRONIC COMPONENTS AND EQUIPMENT	0.0211	0.0241	1.15	0.0627	2.97
TRANSPORTATION EQUIPMENT	0.0068	0.0105	1.54	0.0316	4.65
PROFESSIONAL, SCIENTIFIC EQUIPMENT AND MISCELLANEO	0.0225	0.0284	1.26	0.0702	3.12
TRANSPORTATION SERVICES	0.0229	0.0289	1.26	0.0761	3.33
TRUCK TRANSPORTATION	0.0207	0.0302	1.46	0.0762	3.69
COMMUNICATION	0.0207	0.0265	1.28	0.0706	3.41
UTILITIES	0.0046	0.0088	1.90	0.0305	6.61
WHOLESALE TRADE	0.0247	0.0376	1.52	0.0917	3.71
RETAIL TRADE	0.0506	0.0600	1.19	0.1126	2.22
F.I.R.E.	0.0132	0.0191	1.45	0.0664	5.04
HOTELS AND LODGING PLACES	0.0390	0.0489	1.25	0.0923	2.37
PERSONAL AND REPAIR SERVICES	0.0196	0.0255	1.30	0.0699	3.57
BUSINESS AND PROFESSIONAL SERVICES	0.0316	0.0381	1.21	0.0864	2.73
AMUSEMENT AND RECREATION SERVICES	0.0331	0.0421	1.27	0.0859	2.59
HEALTH SERVICES	0.0318	0.0370	1.16	0.1000	3.14
EDUCATION SERVICES ,NON-COMMERCIAL R & D,NON-PROFI	0.0420	0.0496	1.18	0.1097	2.61
GOVERNMENT NOT ELSEWHERE CLASSIFIED	0.0300	0.0378	1.26	0.1013	3.38